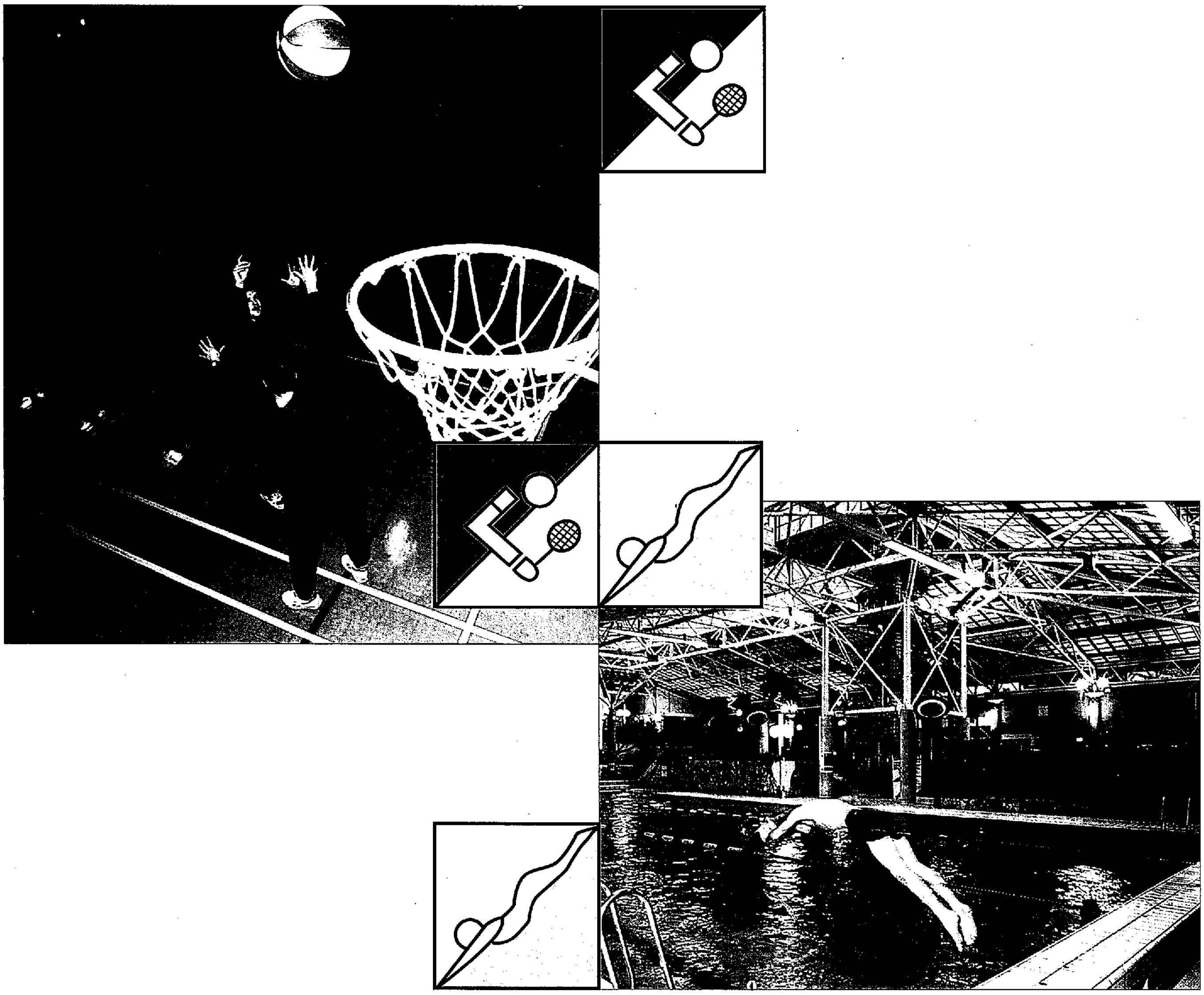
Guide 51

Energy efficiency in sports and recreation buildings: a guide for owners and energy managers



SPORTS COUNCIL

ISRM
The Institute of Sport & Recreation Management

ILAM
Institute of Leisure & Amenity Management

BEST PRACTICE PROGRAMME

ENERGY EFFICIENCY
DEPARTMENT OF THE ENVIRONMENT, TRANSPORT AND THE REGIONS

Big scope for improvement

Energy costs in the sports and recreation sector are currently estimated to be over £600 million per year (equivalent to more than 40 000 million kWh/year of primary energy). As a direct result of this energy consumption, over 9 million tonnes of carbon dioxide (a major contributor to the 'greenhouse effect') is being released to the atmosphere each year.

In a typical sports centre, the cost of energy is second only to that of labour, accounting for up to one-third or more of the total running costs.

Studies show that an average centre could reduce its energy consumption by 30%, with the savings giving a total payback on investment of less than 3 years. At least half of this potential saving can usually be achieved by a combination of relatively simple measures on which the payback is far better than 3 years.

INTRODUCTION

By adopting a programme of energy efficiency, energy consumption at a typical sports centre can be reduced by up to 30%, with commensurate cost savings. This Guide shows you how to:

- assess your centre's energy consumption compared to yardstick values
- determine how best to reduce energy consumption at your centre.

It also describes some of the common actions that can be taken to achieve major improvements. Many of these actions cost little or nothing to implement.

Sports centres vary in size and facilities, but most can be included in one of three basic categories (figure 1). For each type of centre, the Guide considers annual fossil fuel and electricity use per m^2 of floor area in terms of energy consumption (kWh/m^2); cost (£/m^2); and consequent carbon dioxide (CO_2) emissions (kg of CO_2 per m^2). Table 1 gives annual amounts, divided by the total floor area of the centre (including all ancillary areas such as changing rooms, corridors, bars and offices). The cost figures shown include estimated maximum demand, availability and standing charges together with yardsticks for 'GOOD', 'FAIR' and 'POOR' energy performance.

GOOD: sports centres in this category generally have effective controls and energy management procedures, but further energy savings are often still possible.

FAIR: refers to sports centres which have some controls in place and possibly some limited energy management procedures, but should be able to achieve significant energy savings.

POOR: sports centres in this category have unusually high energy consumption. It is recommended that a full energy survey is undertaken to assess the reasons for the high energy use prior to any investments being undertaken. The potential energy savings to be made by sports centres in this category are likely to be substantial.

HOW WELL ARE YOU DOING?

Readers with responsibility for centres that have energy consumptions in the 'fair' or 'poor' categories should regard the values given under the 'good' columns as targets to aim for, but those with entries that are already in the 'good' category should not be too complacent – there is almost always room for further energy savings, thus improving the environment and reducing operating costs.

Separate annual energy use target figures are provided for fossil fuels (gas, oil, solid fuel and LPG) and electricity, for each of the three sports centre types noted.

Fossil fuels and electricity should always be considered separately because of their significantly different costs and environmental impacts. Their consumption figures should not be added together to give a total consumption as this can give a misleading impression of a sports centre's energy consumption and/or efficiency. Conversion factors to kWh for various fossil fuels are given in table 4 (page 6).

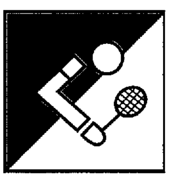
To compare a sports centre with these target figures requires separate annual energy consumptions in kWh and £ for the fossil fuels and electricity used in the centre (these can be obtained from the past year's bills or from meter readings if available), along with the total enclosed floor area of the centre, including any pool area.

The floor area should be obtained in square metres and encompass all internal areas, including storage areas and plant rooms. The only areas which should be excluded are those which are insulated from the heated spaces of the centre and are thus essentially at external temperatures.

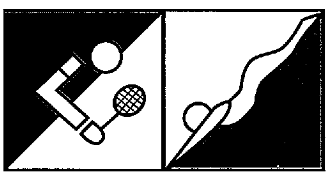
The forms provided in the Appendix can be used to obtain energy performance indicators (for comparison with table 1), and target figures for your centre.

Swimming pools are major consumers of energy. Although table 1 gives performance indicators for the centre as a whole, it will greatly help an analysis if the energy used in the pool and pool hall can be separated from that used in the rest of the complex. Table 2 provides 'good', 'fair' and 'poor' ranges based on pool water area (instead of entire complex area, as in table 1). A specimen calculation separating dry and pool areas is provided in the Appendix.

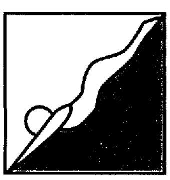
To assess the performance of a sports complex which has an ice rink, the energy use in the rink and the rink area must be separated from the rest of the complex before undertaking any calculations.



Sports facility without a pool
Typically offers predominantly dry sports facilities. Some wet facilities such as steam rooms, sauna and whirlpools may also be offered, but no swimming areas.



Sports facility with a pool
Typically offers significant wet and dry sports facilities in one location, served by common plant rooms. There is usually at least one swimming pool and one sports hall.



Swimming pool only
Typically offers predominantly wet sports facilities. Some dry sports facilities such as multigyms, small club rooms, etc, may also be provided, but no large sportshall.

Figure 1 Categories of sport centres used in this Guide

Centre type	Energy source	Energy (kWh/m^2)			Cost (£/m^2)			CO_2 emissions (kg of CO_2/m^2)		
		Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Without a pool	Fossil fuels	<215	215-325	> 325	< 2.6	2.6-4.0	> 4.0	< 41	41-62	> 62
	Electricity	< 75	75-85	> 85	< 4.7	4.7-5.3	> 5.3	< 47	47-54	> 54
With a pool	Fossil fuels	<360	360-540	> 540	< 4.4	4.4-6.6	> 6.6	< 68	68-100	>100
	Electricity	<150	150-205	> 205	< 9.4	9.4-12.8	>12.8	< 95	95-130	>130
Pool only	Fossil fuels	<775	775-1120	>1120	< 9.5	9.5-13.8	>13.8	<150	150-210	>210
	Electricity	<165	165-235	> 235	<10.3	10.3-14.7	>14.7	<100	100-150	>150

Table 1 Annual energy use, cost and CO_2 emissions per m^2 of entire building

Where a sports centre has air-conditioning, the annual energy use and cost for those areas in which it is installed would normally be significantly higher than stated here.

Centre type	Energy source	Energy (kWh/m^2)			Cost (£/m^2)		
		Good	Fair	Poor	Good	Fair	Poor
Pool only	Fossil fuels	<2950	2950-4300	>4300	<36.3	36.3-52.9	>52.9
	Electricity	< 550	550-900	> 900	<34.3	34.3-56.2	>56.2

Table 2 Annual energy use and cost per m^2 of pool surface

FACTORS INFLUENCING ANNUAL ENERGY COSTS

Sports centres' annual energy costs are primarily determined by the types and amounts of fuel used, and the tariff structures under which they are purchased.

The other main influences on the annual fuel bill are the proportion of the supplied energy use which is due to electricity, as this is by far the most expensive fuel used, and the efficiency with which the fuels are used.

The prices paid for the fuels, and their relevant tariffs, are important. Significant savings can be made by optimum selection of tariffs and suppliers. The new structure of the fuel industries means that larger energy users, such as sports centres, can often negotiate better tariff rates than have traditionally been offered.

In order to ensure you pay the cheapest price for fuel, you may need to use a specialist consultant or negotiate regularly with energy suppliers. However, be aware of consultants' charges.

FACTORS INFLUENCING ANNUAL ENERGY USE

The figures in the tables have been obtained from sports centres around the country over a number of years. The figures are accurate enough to obtain a rapid appraisal of a sports centre's performance but do not allow for the effects of:

- exceptionally high or low hours of use
- exceptional exposure conditions
- abnormal weather conditions
- number of users
- modern facilities
- building design.

Hours of use

Any changes in hours of use will be reflected in a similar change in the fossil fuel and electricity requirements. The figures in this Guide are based on an annual 4800 hours of use. Variations in annual fuel use due to this factor are likely to be around ±10%.

Exposure conditions

Identical buildings situated in sheltered and severe exposure conditions will usually require different amounts of energy for heating and ventilation. In a very exposed location an increase of up to 10% in heating energy use might be expected, and for very sheltered sites a reduction of up to 10% might occur. The standard of building fabric insulation at a sports centre will also have a marked effect on energy use, particularly where there is a swimming pool.

Weather conditions

Heating energy consumption is affected by outside temperature, which is usually measured by the number of 'degree-days' below 15.5°C (for further information on degree-days see Fuel Efficiency Booklet 7[1]). Other temperature bases can also be used. Monthly degree-day values are published for various regions in the UK. Degree-day values appropriate to specific sites may be collected by data loggers or purchased from specialist companies. The simplest means of obtaining the annual number of degree-days for a particular area is to ring the regional environmental and energy management contact (see page 6) or to obtain the Department of Environment's bi-monthly journal, 'Energy Management'.

Number of users

The number of users of a sports centre may influence the energy consumption due to increased demand for showers, freshwater dilution, etc. A variation of around ± 5% in the fossil fuel use might be expected for very high or very low usage levels.

Modern facilities

Modern leisure centres (figure 2) tend to have additional energy consuming features not normally associated with traditional sports centres such as wave machines, flumes, and saunas. These features, mostly associated with pools, will use more fossil and electrical energy and usually the buildings are fairly modern. This additional use should be offset by more energy efficient designs and plant. The target figures given therefore also apply to these centres.

Building design

The energy efficiency of a building is greatly influenced by its design and the materials from which it is constructed. Modern buildings which have been designed to high insulation standards, and to utilise solar gains and as much natural daylight as possible, can substantially reduce the annual energy requirements of a sports centre. Actual savings depend very strongly on design, location and the activities to be undertaken in the building.

WHERE ENERGY IS USED IN SPORTS CENTRES

To reduce the energy consumption in a sports centre there is first a need to know where it is being used and in what quantities. Table 3 shows examples of the energy consumption by end use at three sports centres. These breakdowns are only intended to provide an insight into where energy is used and may not be representative of other sports centres of the same type.

The only way of obtaining similar figures for other sports centres would be to do an energy audit[2][3]. This would be recommended for any sports centre but particularly where energy consumption is around the 'poor' rating.

HOW TO REDUCE THE ENERGY CONSUMPTION OF A SPORTS CENTRE

Obtaining a target energy consumption range and current energy rating is the first stage in the overall objective of reducing both the energy consumption and costs of a sports centre. To achieve the target economically it will be necessary to implement an energy conservation programme, which must include the following elements:

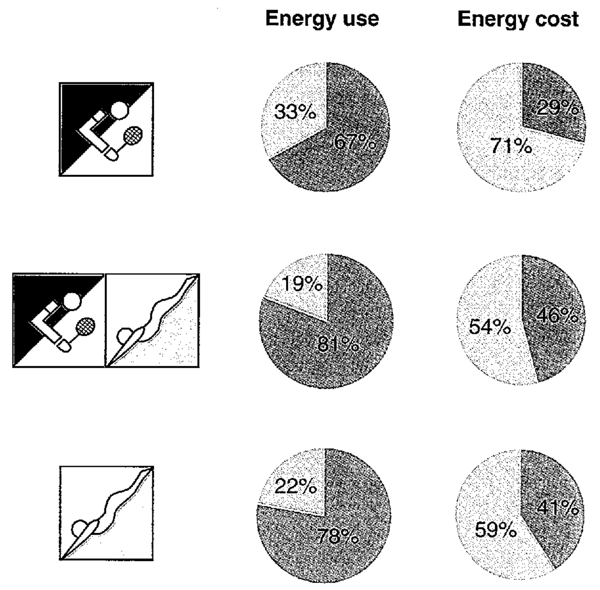
- Senior management commitment, together with a clear policy statement, is the most important element. Without management support the programme will either under achieve or fail completely.
- An ongoing monitoring programme to provide relevant data on energy use, and effective system controls.
- Clearly defined responsibilities, including one person who is accountable for, and has direct knowledge of, energy use in the centre.
- Involvement of all sports centre staff in delivering good housekeeping.
- Regular progress reports to motivate senior personnel responsible for investment decisions and all staff.

Other elements may be included, but these are the components crucial to a successful programme. Further details are given in Good Practice Guide146[4].

BENEFITS OF A MONITORING SCHEME

A monitoring programme helps, in the following ways, to identify energy wastage and trends in energy consumption. It:

- allows the rapid detection of increased utility use (water can be included in this), and enables potentially expensive faults or oversights to be corrected quickly
- enables the energy consequences of various actions to be more accurately gauged and hence accurate predictions of energy use, savings and cost can be derived
- allows the energy use of the sports centre to be compared with that of other sports centres to ascertain whether or not further improvements in energy use may be possible



Breakdown by end use

	kWh (%)	£ (%)
Space heating	64	28
Water heating	3	1
Fans and pumps	13	27
Lighting	16	35
General power	4	9

	kWh (%)	£ (%)
Space heating	52	29
Water heating	29	17
Fans and pumps	12	35
Lighting	4	11
General power	3	8

	k Wh(%)	£ (%)
Space heating	53	28
Water heating	25	13
Fans and pumps	10	27
Lighting	6.5	16
General power	5.5	16

gas/oil/coal at 1.23 p/kwh   electricity at 6.24 p/kwh

Table 3 Examples of energy use, costs and end use in sports centres

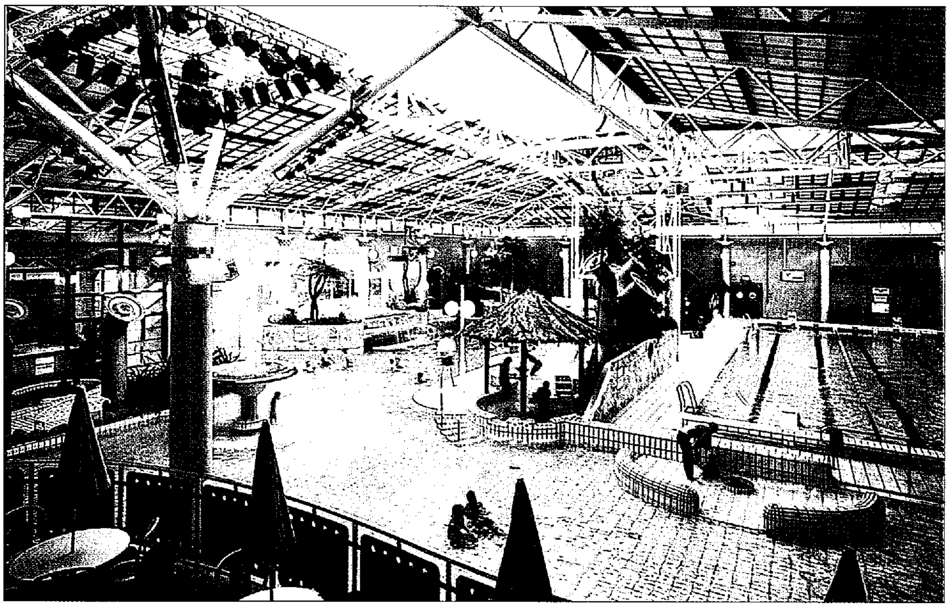


Figure 2 Modern facilities

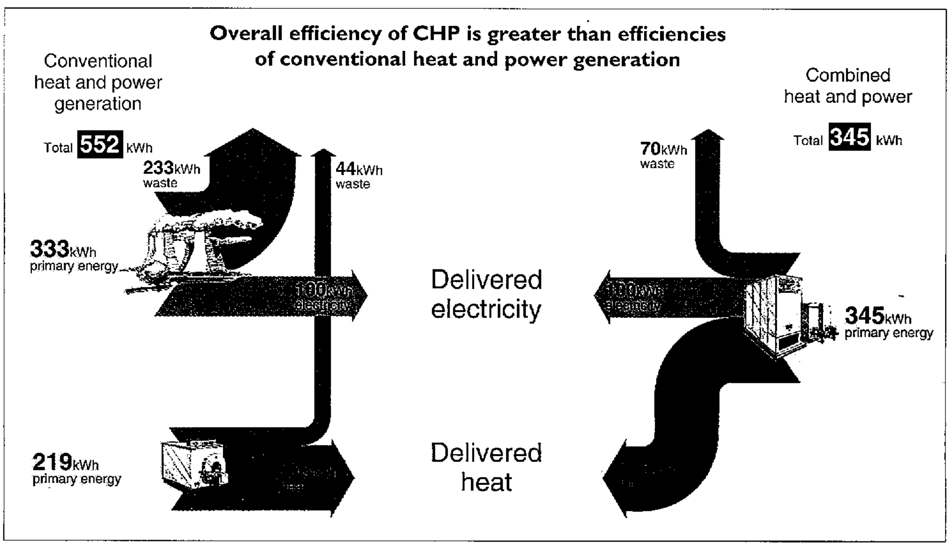


Figure 3 Typical reduction in primary energy consumption when using CHP unit

- furnishes senior management with the information they need to have confidence in the measures undertaken
- enables the effect of fuel price increases on the energy bills to be assessed – it is quite possible to reduce energy consumption in a building but still see the energy bill rise as a result of fuel price increases. It is therefore important that these effects can be demonstrated
- provides a far clearer picture of energy use and may supply you with sufficient information to negotiate more favourable cost terms with the energy suppliers.

Further information on monitoring and targeting can be found in Good Practice Guides 31[5] and 146[4].

MEASURES FOR IMPROVING ENERGY EFFICIENCY

Good housekeeping measures

Those measures which require no capital expenditure are commonly referred to as good housekeeping measures. It is imperative that all such measures applicable to your centre are undertaken before any capital investment in energy conservation is considered. This is because the feasibility of options such as boiler replacement and CHP installation depends crucially on existing energy needs. Good Practice Guides 129[6] and 130[7] provide more detailed guidance on good housekeeping measures applicable to sports centres and swimming pools respectively.

Typical good housekeeping measures for sports centres include:

- setting timeclocks properly for all timed equipment
- ensuring air and water temperatures are set appropriately and monitored regularly
- checking that ventilation rates are appropriate for the activities being undertaken
- rectifying draught problems before the heating season begins
- turning off lights for those facilities not in use, eg squash courts and halls
- fixing leaks and drips immediately
- training to ensure staff know how the controls under their responsibility operate
- ensuring that items installed to save energy, such as pool covers are properly and regularly used
- effective and proper maintenance of all heating and ventilation plant[8].

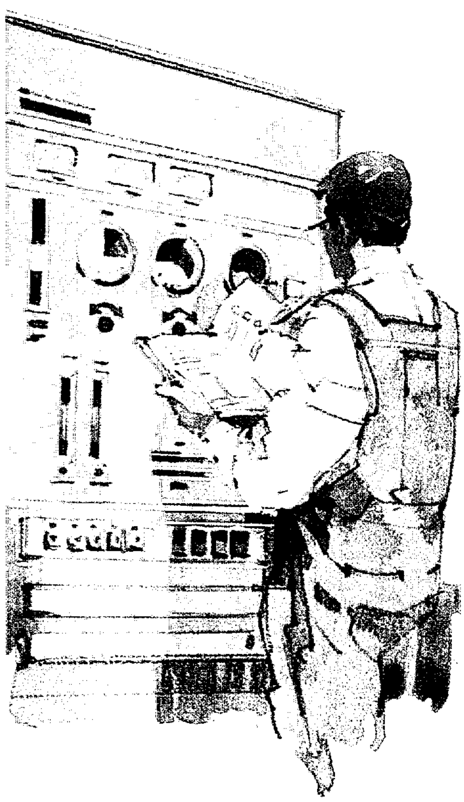
Long-term investment plan

Once all relevant good housekeeping measures have been undertaken you should wait a few months for new energy usage patterns to be established. Investment can now be more confidently targeted at measures which will provide the greatest returns. Before investing any capital, however, a long-term investment plan must be produced. This will minimise the risk of wasting capital such as would occur, for example, if new boilers were installed one year and a CHP system the next; the latter would remove the need for some of the newly installed boiler capacity.

The likely effect of any energy conservation measures on the overall energy consumption patterns and costs should be clearly understood before investing. If unsure about what measures to undertake, a consultant should be engaged to suggest suitable investment paths based on your monitored data, potential capital investment and required investment returns. Check page 5 for equipment you might need to consider.

COMBINED HEAT AND POWER (CHP)

CHP units potentially offer the greatest reduction in energy running costs at a sports centre (figure 3). They burn fossil fuels, typically gas or oil, to generate electricity on-site at a fraction of the cost of the public supply, and to provide heat for space and water heating. Successful installations depend on, matching size to heating and electrical demand, making sure the unit is well controlled, and ensuring that the unit will be run for sufficient hours to make it economic. The feasibility of a CHP system should be evaluated after it has run for some time and suitable energy management procedures have been introduced. CHP units increase the fossil fuel consumption at a site but reduce its electricity consumption. The overall effect is usually a significant reduction in total energy costs.



Monitoring can help identify energy wastage and energy use trends

Further information about CHP can be found in Good Practice Guide 176 (in preparation).

How to obtain an energy consumption rating for a centre with CHP

After dividing actual consumption by floor area, you need to convert both the target electrical consumption (table 1) and the actual electrical consumption into primary energy, by multiplying by 3.5 (this factor reflects the approximate generating efficiency at power stations). These electricity figures can then be added to the target and actual gas consumptions.

Example

A swimming pool centre with a CHP unit occupies 1500 m^2 and uses 1.3 million kWh of gas annually. The CHP unit supplies some of its electrical requirements but a further 0.2 million kWh of electricity must still be purchased annually.

Purchased electricity

= 0.2 million kWh

Fossil fuel consumed in producing electricity in power station

= 0.2 x 3.5

= 0.7 million kWh

Total fossil fuel consumption

= 0.7 +1.3

= 2.0 million kWh

This corresponds to 2 million/1500

=1333 kWh/m^2

From table 1, a good rating is implied if primary energy consumption is less than:

775 + (165 x 3.5)

= 1353 kWh/m^2

CONCLUSIONS

Considerable scope exists for reducing the sports and recreation sector's annual £600 million energy bill. Half of the total savings available can be achieved by simple, low-cost measures. All such measures applicable to your centre should be undertaken before any decisions are made to proceed with more substantial capital investment in energy efficiency.

The first move towards reducing energy consumption and costs is to obtain a target consumption range and current energy rating, by following the examples in this Guide. This should be followed by the introduction of an energy conservation programme under which regular monitoring of consumption and costs is carried out.

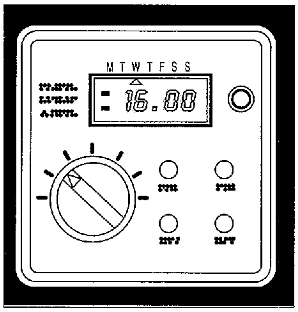
Assistance may be required from a consultant if you lack the in-house expertise to convert your knowledge into investment decisions. Further advice on energy efficiency in the sports and recreation sector can be obtained from the organisations listed on page 6 under 'Useful Contacts'.

Energy Efficiency Measures Requiring Capital Investment

Certain areas in sports centres are known to be good targets for reducing energy consumption and costs. This page outlines important measures which are worth considering. These are dealt with in more depth in Good Practice Guide 144[9]

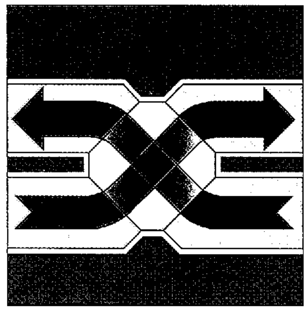
Control systems

Ensure that any control systems already in place are operating correctly. For older sports centres which have not been regularly maintained it will probably be most cost-effective to have the control systems recommissioned. This will immediately highlight poor component performance and failures, and will also show up areas where new controls or plant would make economic sense. Good Practice Guide 137[8] provides further details.



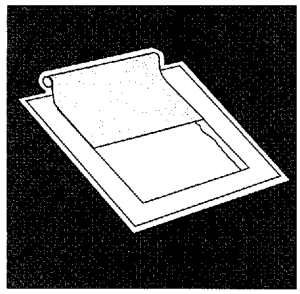
Heat recovery

Heat recovery from the exhaust air should be seriously considered where a swimming pool is involved, as the energy savings can be significant.



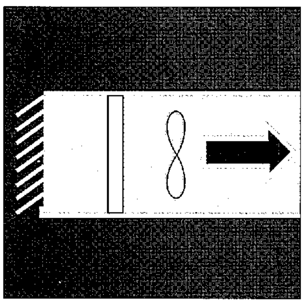
Pool covers

Pool covers can greatly reduce energy consumption. Good Practice Case Study 76[10] shows that the payback period on a pool cover for most pools should be well within any normal financial criteria.



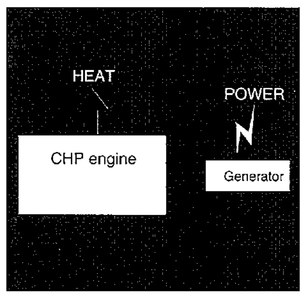
Ventilation fans

Large cost savings can be realised by better control of both time settings and flow rates. In particular, Relative Humidity control of swimming pool hall supply and extract fans, by means of variable speed fans, can achieve significant energy savings.



Combined heat and power

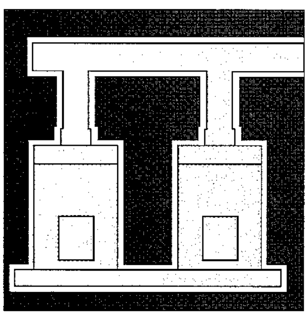
The use and benefits of CHP in sports centres with swimming pools is now well established. Further details on the cost-effectiveness and implementation of CHP systems are provided earlier in this guide and in Good Practice Guide 1[11], 3[12] and 144[9], and Good Practice Case Studies 280[13] and 281[14].



Condensing boilers and modern efficient/modular boilers

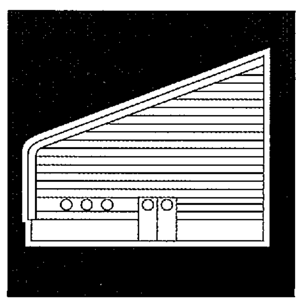
The introduction of state-of-the-art boilers into a sports centre can dramatically reduce fossil fuel costs over a year. These more efficient boilers should now be fitted when replacing old boilers which have come to the end of their service lives.

Further information on the benefits and applicability of the various boilers is provided in references Good Practice Guide 144[9], Good Practice Case Study 43[15], and CIBSE Applications Manual AM3[16].



Fabric improvements

Improving the insulating properties of the fabric of a sports centre can result in significant reductions in energy requirements. The savings are usually insufficient to justify improvements where the fabric is still sound, but where refurbishments are being undertaken the savings achievable can justify increasing the capital expenditure to specify higher performance materials, especially for pools.



Fuel	kWh conversion
Medium fuel oil	11.3 kWh/litre
Light fuel oil (200 sec)	11.2 kWh/litre
Heavy fuel oil	11.4 kWh/litre
Gas Oil	10.6 kWh/litre
Natural gas	10.7 kWh/m^3
Diesel	10.8 kWh/litre
Liquid petroleum gas (LPG)/propane	13 780 kWh/tonne
Coal (anthracite)	9.0 kWh/kg
Coal (bituminous)	8.9 kWh/kg

Table 4 Approximate conversion factors to kWh for stated fuels

COST FACTORS

In all the tables and figures it is assumed that the fossil fuel used is gas. The cost ranges are derived directly from the energy consumption ranges by assuming that the overall average cost per kWh for gas is 1.23 pence and for electricity is 6.24 pence (1994 prices).

ENERGY AND THE ENVIRONMENT

The burning of fossil fuels to generate energy releases gases into the atmosphere. These include sulphur dioxide, which gives rise to acid rain, and carbon dioxide (CO_2), which is the main contributor to the threat of global warming. The amount of carbon dioxide released per kWh produced for each fuel type is:

gas	0.19 kg
oil	0.28 kg
coal	0.32 kg
electricity	0.63 kg

The high CO_2 release associated with electricity reflects the average amount of fossil fuel needed to generate 1 kWh of electricity.

Regional environmental and energy management contacts

Scotland	Edinburgh	0131 244 7137
Wales	Cardiff	01222 823126
North East	Newcastle upon Tyne	0191 201 3614
Yorkshire and Humberside	Leeds	0113 283 6376
North West	Manchester	0161 952 4282
East Midlands	Nottingham	0115 971 9971
West Midlands	Birmingham	0121 626 2222
Eastern	Bedford	01234 796194
South West	Bristol	0117 900 1700
South East	Guildford	01483 882255
Northern Ireland	Belfast	01232 529900

REFERENCES

Fuel Efficiency Booklets, Good Practice Guides and Case Studies are available from BRECSU and ETSU (addresses on back page).

[1] Fuel Efficiency Booklet 7. Degree days

[2] CIBSE Applications Manual AM5. Energy audits and surveys

[3] Fuel Efficiency Booklet 1B. Energy audits for buildings

[4] Good Practice Guide 146. Energy efficiency in sports and recreation buildings: managing energy

[5] Good Practice Guide 31. Computer aided monitoring and targeting for industry

[6] Good Practice Guide 129. Good housekeeping in dry sports centres

[7] Good Practice Guide 130. Good housekeeping in swimming pools: a guide for centre managers

[8] Good Practice Guide 137. Energy efficiency in sports and recreation buildings: effective plant maintenance

[9] Good Practice Guide 144. Energy efficiency in sports and recreation buildings: a technology overview

[10] Good Practice Case Study 76. Energy efficiency in sports and recreation buildings: swimming pool covers

[11] Good Practice Guide 1. Guidance notes for the implementation of small-scale packaged combined heat and power

[12] Good Practice Guide 3. Introduction to small scale combined heat and power

[13] Good Practice Case Study 280. Energy efficiency in sports and recreation buildings. CHP – the 'capital purchase' option

[14] Good Practice Case Study 281. Energy efficiency in sports and recreation buildings. CHP – the 'supplier financed' option

[15] Good Practice Case Study 43. Energy efficiency in sports and recreation buildings: condensing gas boilers

[16] CIBSE Applications Manual AM3. Condensing boilers

OTHER USEFUL INFORMATION

The following guidance notes are available from the Sports Council (address below):

Ref no 382	Sports halls, heating and ventilation
Ref no 383	Sports halls – lighting
Ref no 387	Swimming pools – building services

Handbook of sports and recreational building design:

Volume 2	Indoor sports
Volume 3	Ice rinks and swimming pools

USEFUL CONTACTS

Chartered Institution of Building Services Engineers,
Delta House, 222 Balham High Road, London SW12 9BS.
Tel: 0181 675 5211

The Sports Council,
16 Upper Woburn Place, London WC1H 0QP
Tel: 0171 388 1277

The Institute of Sport and Recreation Management,
36/38 Sherrard Street, Melton Mowbray, Leics LE13 1XJ
Tel: 01664 65531

The Institute of Leisure and Amenity Management,
ILAM House, Lower Basildon, Reading, Berkshire RG8 9NE
Tel: 01491 874222

APPENDIX – Assessing current energy performance and producing target figures for your centre

Using the forms

The calculation sheets which follow are designed to enable you to obtain energy performance indicators and target figures specific to your centre. Figure 4 (overleaf) shows you which forms to use for each type of centre. Blank forms are provided (also overleaf) for you to photocopy, and use for your own centre.

Example

The filled forms on this page are for a sports centre with 'dry' areas and a pool hall. Energy consumption in the pool hall is sub-metered so that both parts of the centre can be judged separately. The centre has a total floor area of 3000 m^2. The pool hall occupies a floor area of 550 m^2, of which 312.5 m^2 is pool water area. The energy consumed at the centre is 480 000 kWh of electricity, of which 300 000 kWh is used in the pool hall, and 145 000 m^3 of gas, of which 100 000 m^3 is used for the pool hall.

FORM 1

Assessing annual energy consumption in pool hall

FORM 2

Assessing annual energy consumption in dry area

FORM 3

Calculation of target annual energy consumption figures

Fuel	Pool hall annual energy consumption A	Unit	kWh conversion (see table 4) B	Annual consumption (kWh) A x B = C	Pool water area (m^2) D	Annual consumption per m^2 pool water (kWh /m^2) C ÷ D
Gas	100 000	m^3	x 10.7	1 070 000	312.5	3424
Oil						
Other fossil fuel use						
Total fossil fuel use (sum of above three fuels)				1 070 000	312.5	3424
Electricity	300 000	kWh	x 1.0	300 000	312.5	960
Comparing this pool with the energy efficiency yardsticks in table 2 the electricity use is in the 'POOR' region, and the fossil fuel use is 'FAIR'.						

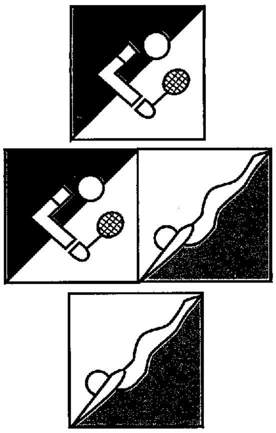
Example of the use of Form 1: Assessing annual energy consumption in pool hall

Fuel	Total annual energy consumption E	Unit	kWh conversion (see table 4) F	Total annual consumption (kWh) E x F = G	Annual consumption pool hall (kWh) C	Annual consumption dry area (kWh) G − C
Gas	145 000	m^3	x 10.7	1 551 500	1 070 000	481 500
Oil						
Other fossil fuel use						
Total fossil fuel use in dry areas. (sum of above three fuels)				1 551 500	1 070 000	481 500 H
Electricity	480 000	kWh	x 1.0	480 000	300 000	180 000 I
The total fossil fuel and electricity use figures must now be divided by the 'dry' area						
Total sports centre area (m^2)			3000 J		Pool hall area (m^2)	550 K
					Dry area (m^2) J − K	2450 L
					Dry area fossil fuel performance (kWh/m^2) H ÷ L	197
					Dry area electrical performance (kWh/m^2) I ÷ L	73
Comparing the performance figures with the target consumptions, which are those for sports facilities without swimming pools in table 1, shows that the dry area annual energy performance is 'GOOD' for both gas and electricity.						

Example of the use of Form 2: Assessing annual energy consumption in dry area

		Targets from tables 1 and 2 (kWh/m^2)				Annual energy consumption targets (kWh)			
		GAS		ELECTRICITY		GAS		ELECTRICITY	
ZONE	Area (m^2) M	GOOD N	POOR O	GOOD P	POOR Q	GOOD N x M	POOR O x M	GOOD P x M	POOR Q x M
'Dry' area	2450	< 215	> 325	< 75	> 85	526 750	796 250	183 750	208 250
Pool hall (pool water area)	312.5	< 2950	>4300	<550	>900	921 875	1 344 000	171 875	281 250

Example of the use of Form 3: Calculation of target annual energy consumption figures



Sports facility without a pool
Use form 2 to assess performance, with C and K zero. Use the first line of form 3 for obtaining the targets.

Sports facility with a pool
Use forms 1 and 2 for assessing performance, and both lines of form 3 for obtaining your targets. *Note that this procedure is only possible if you can separate energy consumption in 'dry' and pool areas – by sub-metering the pool hall, for example.*

Swimming pool only
Use form 1 to assess performance, and the second line of form 3 to obtain targets.

Figure 4

Fuel	Pool hall annual energy consumption A	Unit	kWh conversion (see table 4) B	Annual consumption (kWh) A x B = C	Pool water area (m^2) D	Annual consumption per m^2 pool water (kWh /m^2) C ÷ D
Gas						
Oil						
Other fossil fuel use						
Total fossil fuel use (sum of above three fuels)						
Electricity		kWh	x 1.0			

Form 1: Assessing annual energy consumption in pool hall

Fuel	Total annual energy consumption E	Unit	kWh conversion (see table 4) F	Total annual consumption (kWh) E x F = G	Annual consumption pool hall (kWh) C	Annual consumption dry area (kWh) G – C
Gas						
Oil						
Other fossil fuel use						
Total fossil fuel use in dry areas (sum of above three fuels)						H
Electricity		kWh	x 1.0			I

Total electricity use in 'dry' areas (G) = (E – B)

The total fossil fuel and electricity use figures must now be divided by the 'dry' area.

Total sports centre area (m^2) J

Pool hall area (m^2) K

Dry area (m^2) J – K = L

Dry area fossil fuel performance (kWh/m^2) H ÷ L

Dry area electrical performance (kWh/m^2) I ÷ L

Form 2: Assessing annual energy consumption in dry area

ZONE	Area (m^2) M	Targets from tables 1 and 2 (kWh/m^2) GAS GOOD target N	GAS POOR target O	ELECTRICITY GOOD target P	ELECTRICITY POOR target Q	Annual energy consumption targets (kWh) GAS GOOD N x M	GAS POOR O x M	ELECTRICITY GOOD P x M	ELECTRICITY POOR Q x M
'Dry'area		< 215	> 325	< 75	> 85				
Pool hall (pool water area)		<2950	>4300	<550	>900				

Form 3: Calculation of target annual energy consumption figures

For further copies of this or any other Best Practice programme publications please contact BRECSU and ETSU.

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